TF07

PIR# U-1T80-LSD-MMF-124
Revision A
February 17, 1982

LANDSAT-D

ACCELERATED PAYLOAD CORRECTION SUBSYSTEM

OUTPUT COMPUTER COMPATIBLE TAPE FORMAT

PREPARED FOR

NATIONAL AERONAUTICS AND SPACE FLIGHT ADMINISTRATION

GODDARD SPACE FLIGHT CENTER

GREENBELT, MD

UNDER

CONTRACT NO. NAS5-25300

PREPARED BY

GENERAL ELECTRIC COMPANY

SPACE DIVISION

LANHAM, MD

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PIR NO. U | 1T80 | LSD-MMF | 124 | B

;RAM INFORMATION REQUEST / RELEASE

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

D. Abbott

TO J. D. Efner

SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
30/82 Rev. B			

CT

CEBRATED PAYLOAD CORRECTION SUBSYSTEM OUTPUT CCT FORMAT

RMATION REQUESTED/RELEASED

e following pen-and-enk changes are to be made to Revision A of this PIR:

Page 5-11, items 6 and 7: Standard Format should read 'YYDDDHHMMSSTTTFF' (16 character time in sixteenths of milliseconds).

Page 5-13, items 4 and 5: Number of charaters should read: '21'

Page 5-Z5a, item 27: Number of charaters should read: '14'

Page 5-30, item 35-66: Number of charaters should read: '8'

PAGE NO. 1 OF 1

RETENTION REQUIREMENTS

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SECTION I

SCOPE

1.1 INTRODUCTION

The NASA GSFC Landsat-D Ground Segment (GS) is developing an Accelerated Payload Correction Subsystem (APCS) to provide Thematic Mapper (TM) image correction data to be used outside the GS. This correction data is computed from a subset of the TM Payload Correction Data (PCD), which is downlinked from the spacecraft in a 32 Kbps data stream, and mirror scan correction data (MSCD), which is extracted from the wideband video data. This correction data is generated in the GS Thematic Mapper Mission Management Facility (MMF-T), and is recorded on a 9-track 1600 bit per inch computer compatible tape (CCT). This CCT is known as a APCS Output CCT (AOT). The AOT follows standardized corrections with respect to data formats, record construction and record identification.

Section 1 of this document defines the scope of the document; section 2 delineates any applicable documents; section 3 defines common conventions which are used in further defining the structure, format and content of the AOT. Sections 4 and 5 delineate the details of the structure and content, respectively, of the AOT. Section 6 serves as an appendix of acronyms and special notation used in this document.

1.2 PURPOSE

The purpose of this document is to define the format of the Accelerated Payload Correction Subsystem Output CCT (AOT) which is generated by the Landsat-D Thematic Mapper Mission Management Facility (MMF-T).

This document and those cited in Section 2 provide the complete data format specifications for APCS Output Tapes and should be followed in utilizing and interpreting the format of these AOT's.

1.3 APPLICABILITY

This document applies to all AOT's which are generated by the MMF-T as a part of APCS processing.

SECTION 2

APPLICABLE DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

None

2.2 GENERAL ELECTRIC COMPANY DOCUMENTS

See Appendix I

2.3 OTHER DOCUMENTS

None

SECTION 3

COMMON CONVENTIONS

3.1 BIT

One binary digit (either a zero or a one).

3.2 BYTE

A byte is eight bits in legth and may contain any type of data. The most significant bit occurs first and is the left-most bit of the byte.

3.3 RECORD

A logical record is a stream of data not greater than 2,560 bytes terminated by carriage-return/line feed characters. The record length is dependent on the type of file and on the type of record within a file.
Each AOT data record contains one of many types of information, uniquely identified by the record type code found at the beginning of the record. The record type codes are eight character alphanumerics in ASCII code.

Each record has a standard format as shown in Section 5.

3.4 FILE

A file consists of an integer number of records followed by an end-of-file (EOF) mark. In the interest of tape reliability, every file will be repeated three times The file repetition is such that the second and third copies of each file immediately follows the first copy of the file. The repetition of physical files is not reflected in the remainder of this document. A file connot exceed the length of one reel of magnetic tape. However, multiple files can be stored on a reel. The last file is followed by an end-of-tape maker (EOT).

3.5 TAPE GAPS, MARKERS, AND LABELING

3.5.1 LOAD POINT MARKER

A small piece of reflective aluminum tape is located on the non-recording side a few feet from the beginning of each reel of tape. This load point marker indicates the beginning of the tape for reading and writing.

3.5.2 INITIAL GAP

A gap of 3.0 in. minimum separates the first record on a AOT from the load point marker. A gap maximum of 25 ft. is specified ot permit corrective action when gaps of excessive length are encountered (successive erase instructions).

3.5.3 INTER-RECORD GAP

An inter-record gap of 0.6-in. nominal (0.5-in. minimum, 25-ft. maximum) separates records in a file.

3.5.4 END-OF-FILE-MARKER

A physical gap of 3.5 in. followed by an end-of-file marker (EOF) code separates files on AOT.

3.5.5 END-OF-TAPE MARKER

The end-of-tape marker (EOT) consists of two consecutive EOFs.

3.5.6 TAPE LABELING

The AOT is an ANSI-ASCII labelled tape (no header 3) record. The tape label is 'AOTSCD'.

3.5.7 MULTIPLE VOLUMES

The AOT shall be a single volume (physical reel) of magnetic tape.

SECTION 4

FORMATS

4.1 AOT Format Definition

The major function of an AOT is to provide TM correction data to a user external to the Landsat-D Ground Segment.

It is structured on an HDT-RT basis (with one AOT corresponding to one HDT-RT) and starts with a tape directory identifying the files on the AOT. Each subsequent file begins with a transfer header record followed by a header record containing basic identification and processing information on the data detailed in that file. The transfer header record is used for file identification, tracking and debug purposes. The format for each section is defined below and shown in its corresponding section in Section 5. All fields are coded in The American Standard Code for Information Interchange (ASCII). Numeric fields are right justified with leading blanks. The tables in Section 5 represent a byte-by-byte layout of each record type; there are no embedded blank fields unless otherwise noted. The structure of the AOT is shown in Figure 4-1.

Some overall points apply to the AOT format definition:

a. The year indicator in all spacecraft times on the AOT has been inserted by the MMF-T.

b. All PCD spacecraft times, telemetry spacecraft times and video interval spacecraft times are generated using the same spacecraft clock.

c. The order of the intervals and scenes on the APCS process request are the same order as the data on the HDT-RT.

d. The order of the data within the TM Ancillary and SCD file and Annotation Data file is the same order as the scene records in the APCS process request.

4.2 AOT FILE STRUCTURE

4.2.1 TAPE DIRECTORY FILE STRUCTURE

The tape directory file consists of a transfer header record, a file name header record and one file name record for each unique file on the AOT. The tape directory file appears once per AOT. The structure of the tape directory file is shown in Figure 4-2.

4.2.2 APCS PROCESS REQUEST FILE STRUCTURE

The APCS Process request file appears on the AOT once. The APCS process request file consists of information referencing a set of images corresponding to a single HDT-RT. Each APCS process request file contains one transfer header record, one process request header record and at least one set of process request interval and process request scene records. The structure of the APCS process request file is shown in Figure 4-3.

4.2.3 TELEMETRY INTERVAL EPHEMERIS FILE STRUCTURE

The telemetry interval ephemeris file occurs on the AOT once for every requested telemetry interval. The telemetry interval ephemeris file consists of information referencing a single telemetry interval. Each telemetry interval file contains a transfer header record, one telemetry interval record and at least one telemetry major frame record. The structure of the telemetry interval ephemeris file is shown in Figure 4-4.

4.2.4 TM ANCILLLARY AND SYSTEMATIC CORRECTION DATA FILE STRUCTURE

The TM ancillary and systematic correction data (SCD) file occurs on the AOT once for each requested telemetry interval. The TM ancillary and Systematic correction data file consists of information referencing

requested scenes from a single telemetry interval. Each TM ancillary and systematic correction data file contains a transfer header record, a TM ancillary and SCD header record and at least one TM ancillary and SCD record. The TM ancillary and SCD file structure is shown in Figure 4-5.

4.2.5 ANNOTATION DATA FILE STRUCTURE

The annotation data file occurs on the AOT once for each requested telemetry interval. The annotation data file consists of information referencing requested scenes from a single telemetry interval. Each annotation data file consists of a transfer header record, an annotation header record and at least one annotation scene data record. The structure of the annotation data file is shown in Figure 4-6.

4.2.6 QUALITY ASSURANCE FILE STRUCTURE

The quality assurance (QA) file occurs on the AOT once for each requested telemetry interval. The quality assurance file contains information referencing the requested telemetry interval and information referencing requested scenes from the requested telemetry interval. Each QA file consist of a transfer header record, a QA header record, an ephemeris data processing record, an attitude data processing header record, at least one attitude data processing data record, an MSCDP input data record, at least one MSCDP output data record and at least one SCD scene data record. The structure of the quality assurance file is shown in Figure 4-7.

Figure 4-1 APCS OUTPUT CCT STRUCTURE

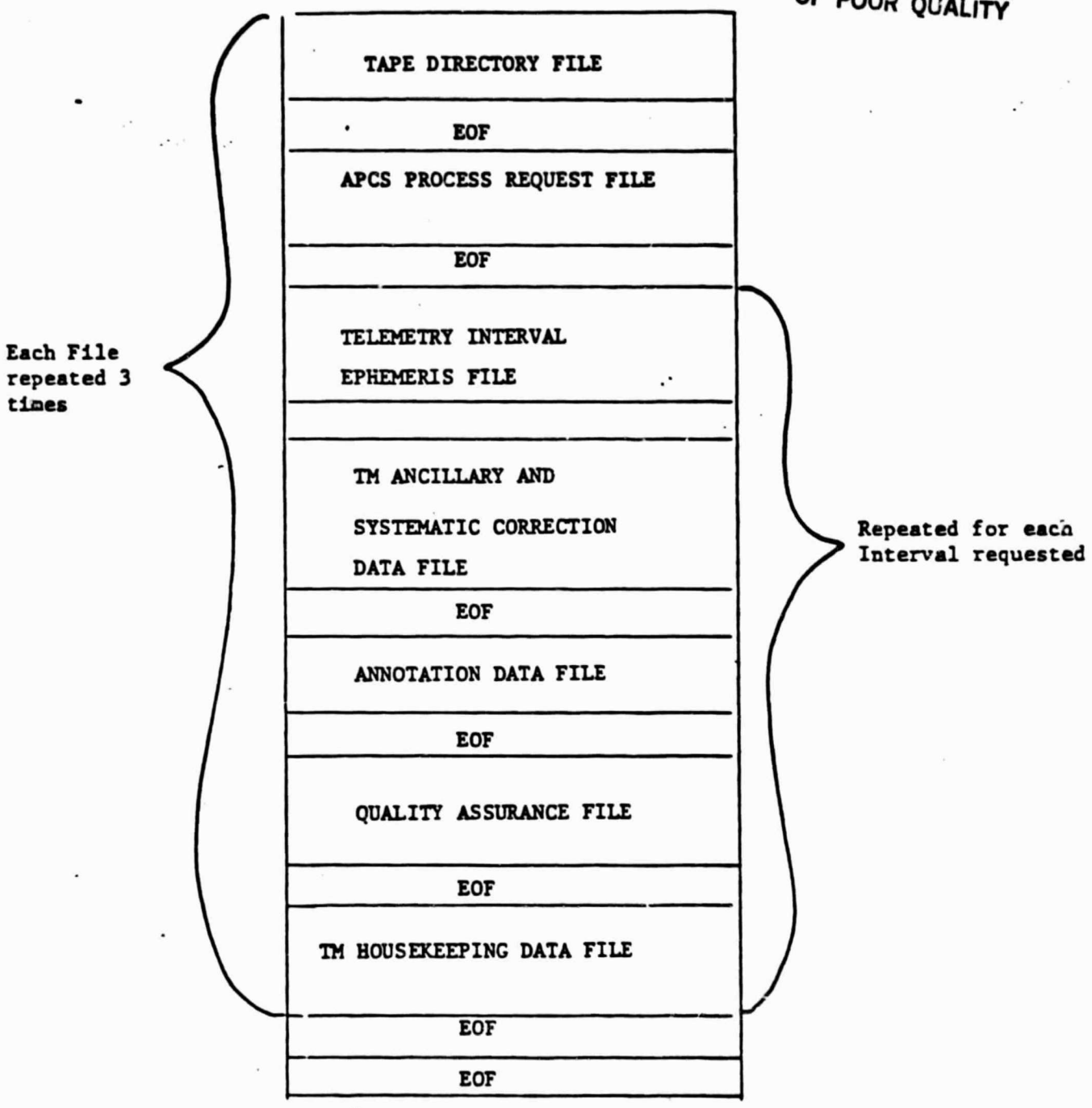


Figure 4-2 TAPE DIRECTORY FILE STRUCTURE

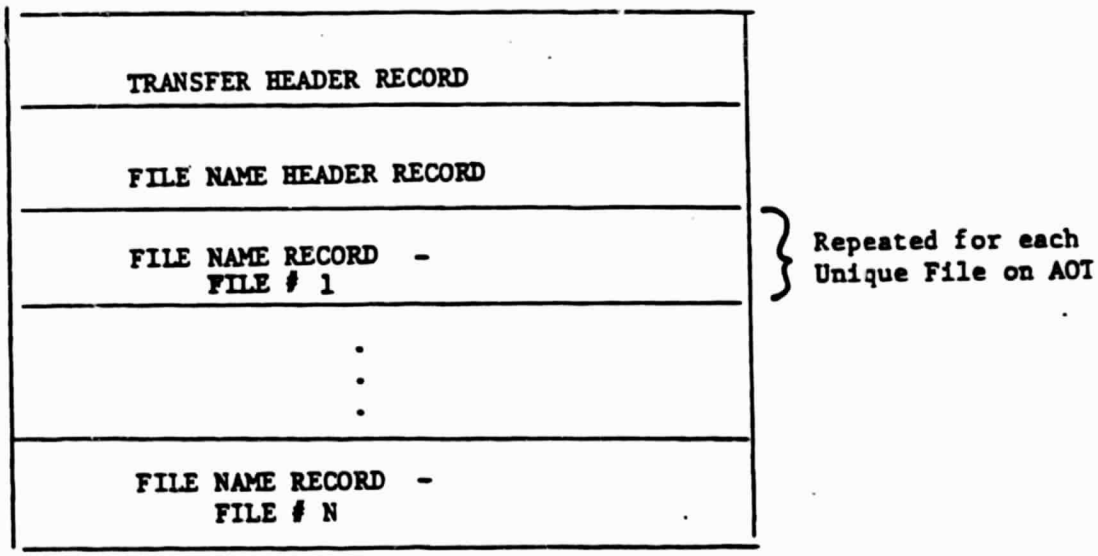


Figure 4-3 APCS PROCESS REQUEST FILE STRUCTURE

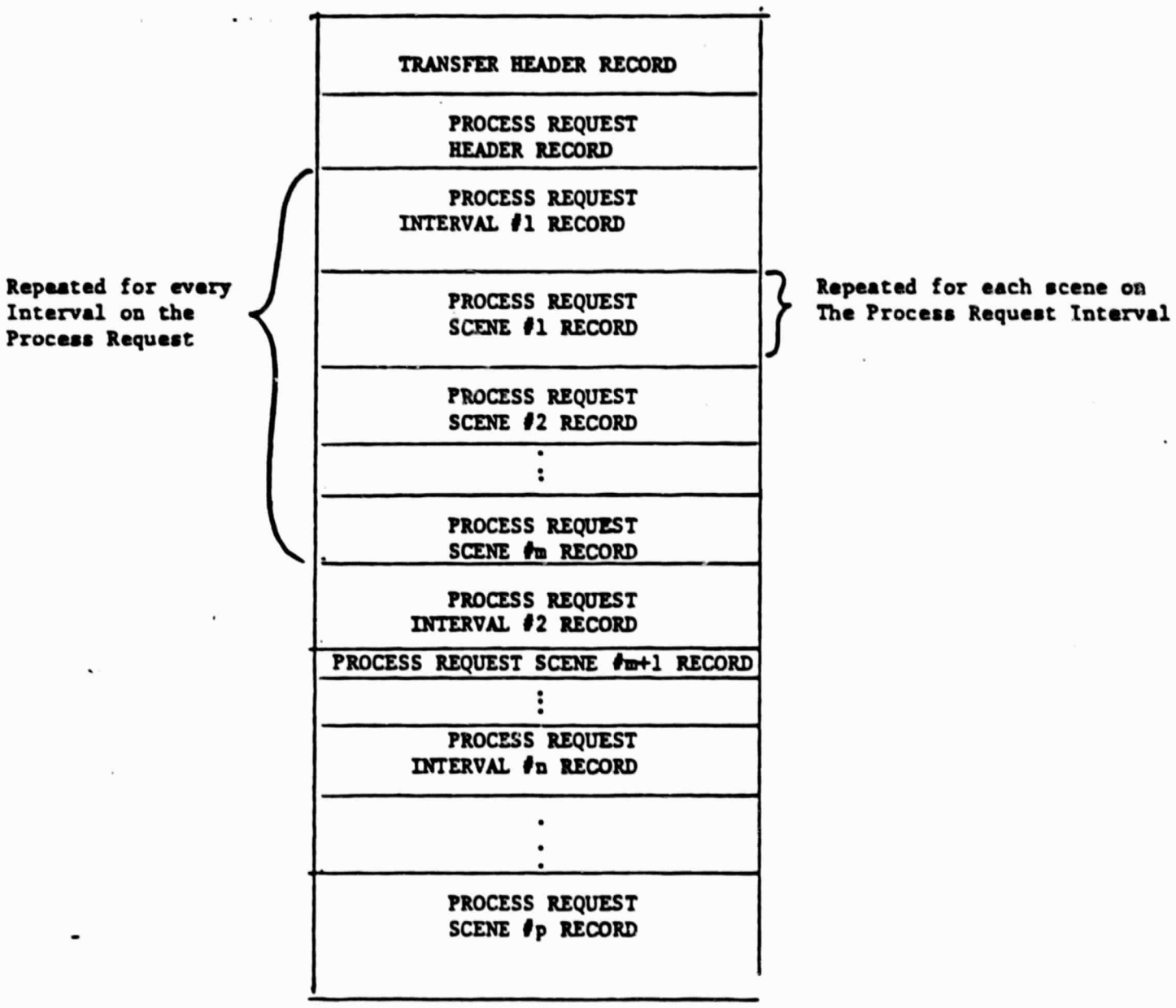


Figure 4-4 TELEMETRY INTERVAL EPHEMERIS FILE STRUCTURE

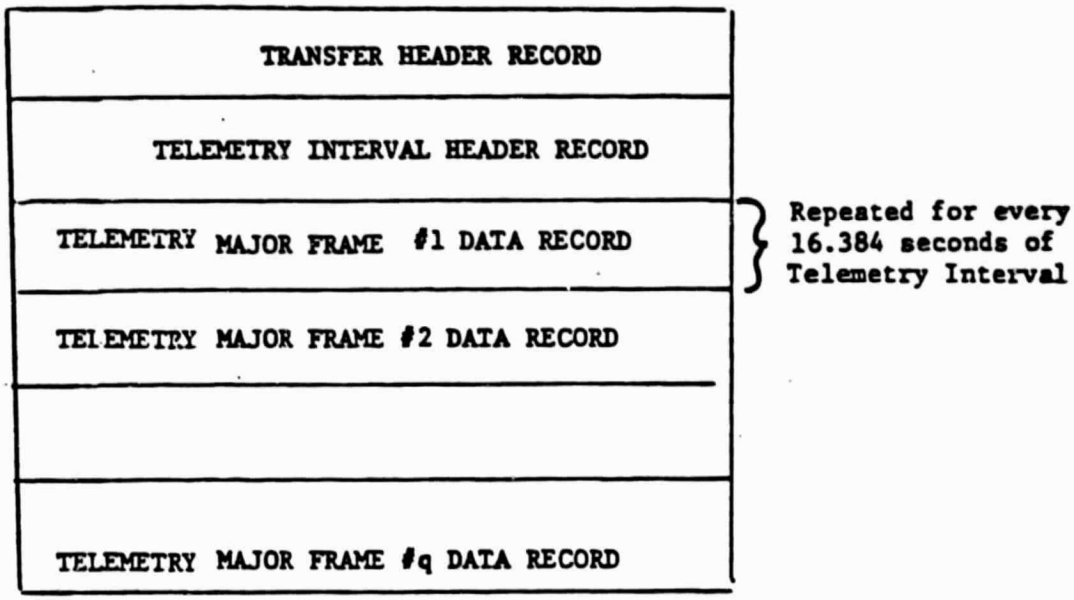
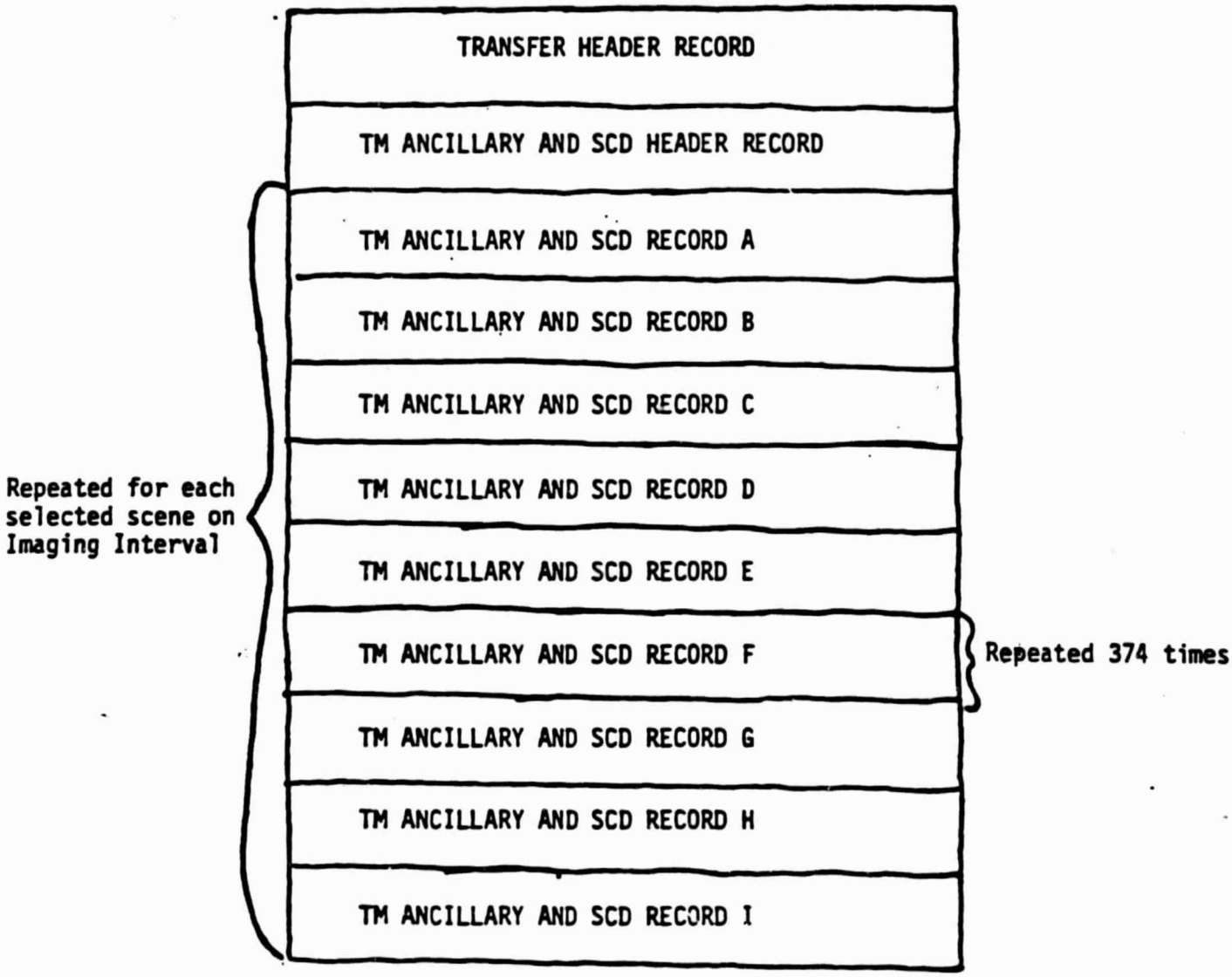


Figure 4-5 TM ANCILLARY AND SYSTEMATIC CORRECTION DATA FILE STRUCTURE



Figures 4-6 Annotation Data File Structure

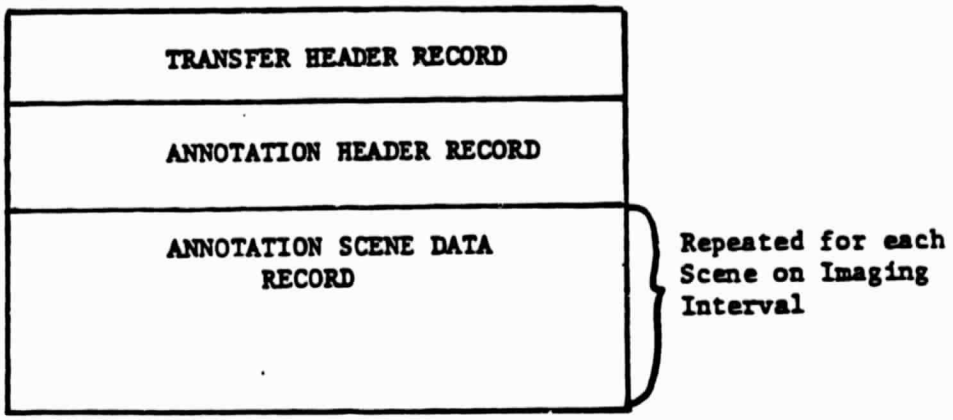


Figure 4-7 QUALITY ASSURANCE FILE STRUCTURE

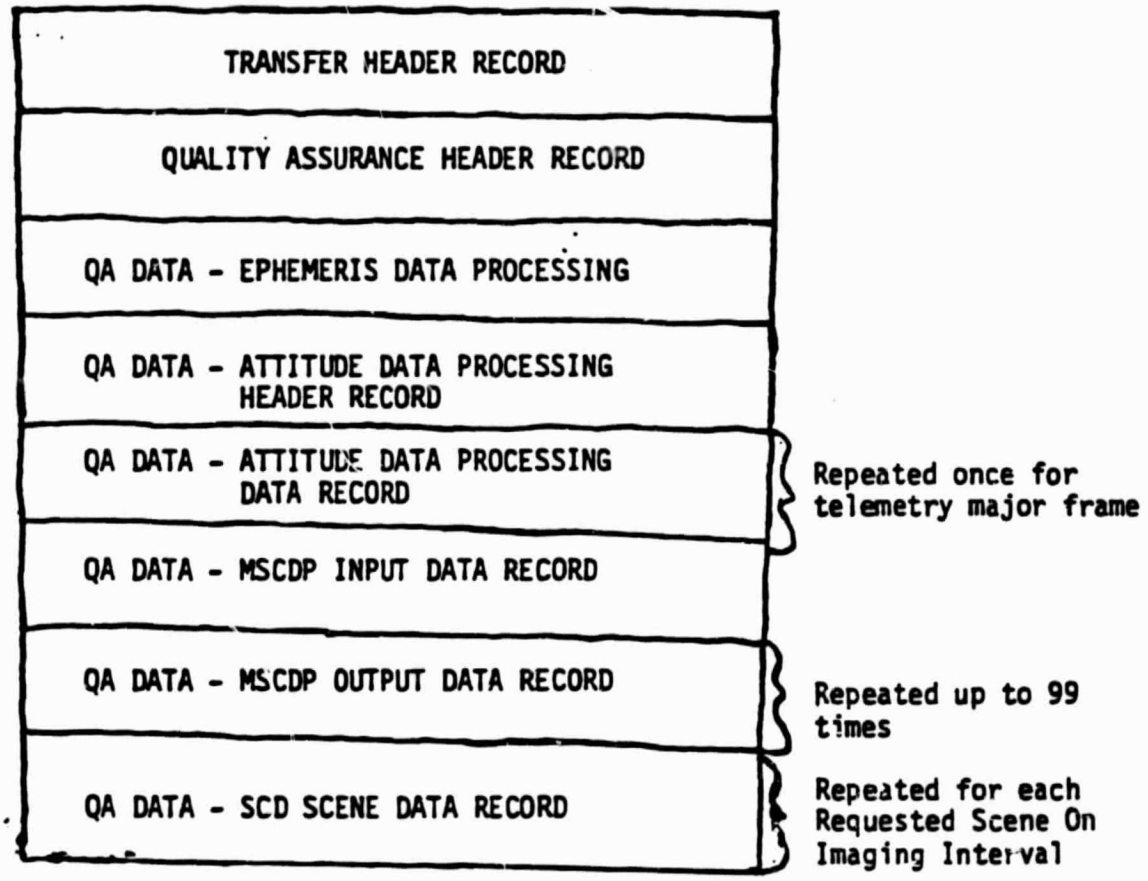
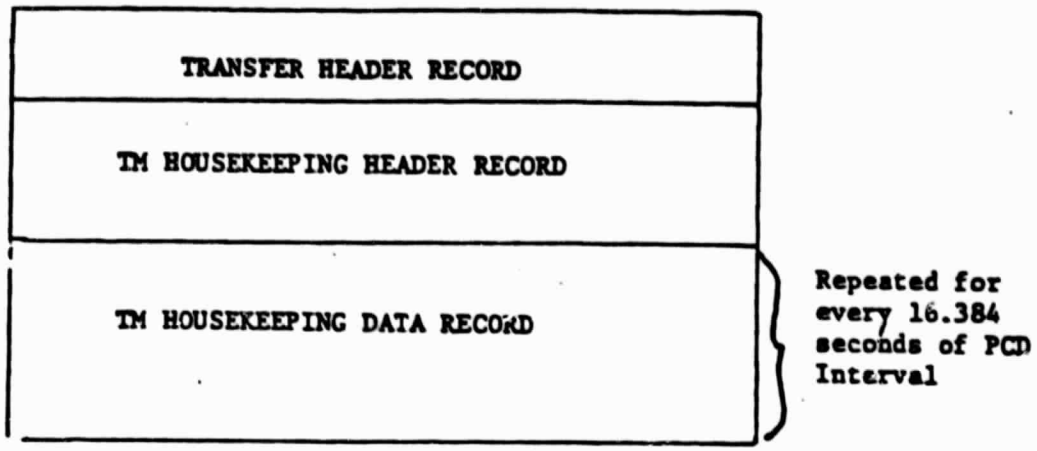


Figure 4-8 TM HOUSEKEEPING DATA FILE STRUCTURE



SECTION 5

RECORD LAYOUTS

Included herein are the contents and format of each of the files, and records discussed in Section 4. Figure 5-1 depicts the general format of AOT data records. Tables 5-1 thru 5-24 depict the format of the data records recorded on the AOT. The transfer header record format is the same for all files and is described in Table 5-25.

The "Item Name" column identifies the item being defined. Further definition of each item may be found in one of the documents referenced in paragraph 2.2. The "Item Number" column indicates the relative order of the item in the record (i.e., first data item, 19th data item, etc.). The "Number of Characters" column defines the size in characters of the data item. The "Standard Format" column further defines the data item in terms of specialized formats standard formats are defined in Section 6.2.

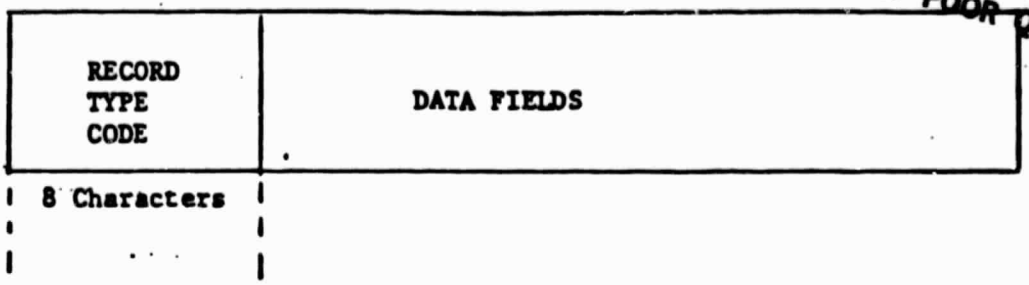


Figure 5-1 AOT Data Record Formats

Table 5-1

Tape Directory File

File Name Header Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZTDBHEAD'
2	2	Number of Unique Files on this tape (Number of File Name Records in this file)	99

Table 5-2

Tape Directory File

File Name Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZTDØNAME'
2	10	File Name	FFFXXX.EXT

Table 5-3

APCS Process Request File

Process Request Header Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZPRØHEAD'
2	12	Process Request Identification	SSSYYDDDXXXX
3	14	Reserved (Blank Fill)	
4	11	Date/Time Process Request Generated	YYDDDHHMMSS
5	12	Input HDT-RT Identification	MNSTTYYDDDXX
6	5	HDT-RT Tape Data Rate	99V999
7	2	Number of Process Request Interval Records in this file	99
8	3	Number of Scene Records in this file	999
9	2	Total Number of Video Intervals on HDT-RT	99
10	3	Total Number of Scenes on HDT-RT (Approximated)	999
11	10	APCS Process Request File Name	FFFXXX.EXT
12	1	Detector #1 Status X = 'G' for good 'B' for bad	X
13	3	Detector #1 Replacement Detector Identification (0-100)	999
14	5	Date of Applicability of Failed Detector #1 (blank if status is good)	YYDDD
15	1	Detector #2 Status	X
.		.	
.		.	
.		.	
311	5	Date of Applicability of Failed Detector #100 (blank if status is good)	YYDDD

Table 5-4

APCS Process Request File

Process Request Interval Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZPRØINTV'
2	12	Process Request Identification	SSSYYDDDXXXX
3	2	Process Request Interval Sequence Number	99
4	12	Reserved (Blank Fill)	
5	2	HDT-RT Interval Sequence Number	99
6	14	HDT-RT Video Interval Spacecraft Start Time	YYDDDHHMMSSTTT
7	14	HDT-RT Video Interval Spacecraft Stop Time*	YYDDDHHMMSSTTT
8	10	HDT-RT Interval Video IRIG Start Time	DDDHHMMSST
9	10	HDT-RT Interval Video IRIG Stop Time	DDDHHMMSST
10	2	Number of Scenes on HDT-RT Video Interval (approximated)	99
11	2	Number of Scene Records in This File Associated with this Process Request Interval	99
12	1	Mission Number X = '4' or '5'	X
13	10	TM Ancillary and SCD File Name	FFFXXX.EXT
14	10	Telemetry Interval Ephemeris File Name	FFFXXX.EXT
15	10	Quality Assurance File Name	FFFXXX.EXT
16	10	TM Housekeeping Data File Name	FFFXXX.EXT
17	10	Annotation Data File Name	FFFXXX.EXT

*Stop time is defined as the start time of the last scan line in the video interval

Table 5-5

APCS Process Request File

Process Request Scene Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZPRØSCEN'
2	12	Process Request Identification	SSSYYDDDXXXX
3	2	Process Request Interval Sequence Number	99
4	12	Geographic Scene Identification	NSPPPRRRDDDD
5	10	NASA Scene Identification	NDDDDHHMMT
6	11	Predicted Spacecraft Scene Center Time	YYDDDHHMMSS
7	10	HDT-RT Scene Video IRIG Start Time (approximated)	DDDHHMMSST
8	10	HDT-RT Scene Video IRIG Stop Time (approximated)	DDDHHMMSST

Table 5-6

Telemetry Interval Ephemeris Data File

Telemetry Interval Header Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZEPBHEAD'
2	16	Telemetry Interval Spacecraft Start Time	YYDDDHHMMSSTTTFF
3	16	Telemetry Interval Spacecraft Stop Time *	YYDDDHHMMSSTTTFF
4	1	Ephemeris Source X 'G' for GPS 'U' for uplinked	X
5	1	Mission Number X = '4' or '5'	X
6	1	Orbital Direction X = 'A' for ascending 'D' for descending	X
7	10	Number of Processed Output Points	I10
8-13	84	Orbital Elements	E14.7

*Stop time is defined as the start time of the last telemetry major frame in the telemetry interval.

Table 5-7

Telemetry Interval Ephemeris Data File

Telemetry Major Frame Data Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZEP␣PMJF'
2	2	Record Sequence Number (Telemetry Major Frame Sequence Number)	99
3	21	Observation Time 1 Relative to Telemetry Interval Spacecraft Start Time	D21.14
4	21	Observation Time 2	D21.14
5	21	Observation Time 3	D21.14
6	21	Observation Time 4	D21.14
7	21	Observation Time 5	D21.14
8	21	Observation Time 6	D21.14
9	21	Observation Time 7	D21.14
10	21	Observation Time 8	D21.14
11	14	Position: X1	E14.7
12	14	Position: Y1	E14.7
13	14	Position: Z1	E14.7
14	14	Velocity: X1	E14.7
15	14	Velocity: Y1	E14.7
16	14	Velocity: Z1	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
56	14	Velocity X8	E14.7
57	14	Velocity Y8	E14.7
58	14	Velocity Z8	E14.7

Table 5-8 TM ANCILLARY AND SYSTEMATIC CORRECTION DATA FILE TM ANCILLARY AND SCD HEADER RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZAS\HEAD'
2	16	Imaging Interval Spacecraft Start Time	YYDDDHHMMSSTTTFF
3	16	Imaging Interval Spacecraft Stop Time	YYDDDHHMMSSTTTFF
4	16	Telemetry Spacecraft Start Time	YYDDDHHMMSSTTTFF
5	16	Telemetry Spacecraft Stop Time	YYDDDHHMMSSTTTFF
6	1	Mission Number: x = '4' or '5'	X
7	2	Number of Scene Record Sets in This File	99

TABLE 5-9 TM ANCILLARY AND SYSTEMATIC CORRECTION DATA FILE

TM ANCILLARY AND SCD RECORD A

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZASØSCDA'
2	2	Scene Sequence Number	99
3	3	WRS Path	999
4	3	WRS Row	999
5	1	Mission Number: x = '4' or '5'	X
6	16	First Scan Spacecraft Start Time (Scan #1)	YYDDHHMMSSTTFF
7	16	Last Scan Spacecraft Start Time (Scan #374)	YYYDDDHHMMSSTTFF
8	21	Scene Center Spacecraft time Relative to PCD Telemetry Start (seconds) (accurate to .13 milliseconds)	D21.14
9	3	Scan Number of Center Sweep* Forward Scan (relative to scan #1 of imaging interval)	99999
10	3	Number of Scans (374)	999
11	14	Earth Radius at Scene Center (Kilometers)	E14.7
12	14	Spacecraft Orbit Radius at Scene Center (Kilometers)	E14.7
13	14	Earth Ellipsoid Semi - Major Axis (Kilometers)	E14.7
14	14	Earth Ellipsoid Semi - Minor Axis (Kilometers)	E14.7
15	14	Cross - Scan Benchmark Matrix Offset (radians)	E14.7

*Sweep is defined as the time between the start of a forward scan to the start of the next forward scan (approximately 143 milliseconds.

Table 5-9a TM ANCILLARY AND SCD FILE
TM ANCILLARY AND SCD RECORD B

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZasØSCDB
2	3	Map Projection #1 Identification	'SOM'
3	4	SOM Map Project Zone Flag	I4
4	21	WRS Scene Center-X (kilometers)	D21.14
5	21	WRS Scene Center-Y (kilometers)	D21.14
6	14	Display Rotation Angle (Degrees)	E14.7
7	14	Horizontal Display Shift (kilometers)	E14.7
-	SCD Benchmark Matrix (Map Projection #1)		
8	14	SPØ (1,1,1) (pixels)	E14.7
9	14	SPØ (2,1,1)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
71	14	SPØ (8,4,2)	E14.7
72	14	SYØ (1,1,1) (pixels)	E14.7
73	14	SYØ (2,1,1)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
135	14	SYØ (8,4,2)	E14.7

TABLE 5-9b TM ANCILLARY AND SCD FILE
TM ANCILLARY AND SCD RECORD C

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZASBSCDC'
2	14	SP1 (1,1,1)	E14.7
3	14	SP1 (2,1,1)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
65	14	SP1 (8,4,2)	E14.7
66	14	SY1 (1,1,1)	E14.7
67	14	SY1 (2,1,1)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
129	14	SY1 (8,4,2)	E14.7

TABLE 5-9c TM ANCILLARY AND SCD FILE
TM ANCILLARY AND SCD RECORD D

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZASØSCDD'
2	3	Map Projection #2 (UTM or PS)	'UTM' or 'PSØ'
3	4	Map Projection Zone Flag*	I4
4	14	WRS Scene Center - X (kilometers)	D21.14
5	14	WRS Scene Center - Y (kilometers)	D21.14
6	14	Display Rotation Angle (degrees)	E14.7
7	14	Horizontal Display Shift (pixels)	E14.7
		SCD Benchmark Matrix (Map Projection #2)	
8	14	SPØ (1,1,1) (pixels)	E14.7
9	14	SPØ (2,1,1,)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
71	14	SPØ (8,4,2)	E14.7
72	14	SYØ (1,1,1) (kilometers)	E14.7
73	14	SYØ (2,1,1)	E14.7
135	14	SYØ (8,4,2)	E14.7

*For UTM, the Map Projection Zone Flag value equals the UTM Central Meridian

For PS, the Map Projection Zone Flag value equals zero.

TABLE 5-9d TM ANCILLARY AND SCD FILE
TM ANCILLARY AND SCD RECORD E

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZASWSCDE'
2	14	SP1 (1,1,1)(pixels)	E14.7
3	14	SP1 (2,1,1)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
65	14	SP1 (8,4,2)	E14.7
66	14	SY1 (1,1,1) (kilometers)	E14.7
67	14	SY1 (2,1,1)	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
129	14	SY1 (8,4,2)	E14.7

Table 5-10 TM ANCILLARY AND SYSTEMATIC CORRECTION DATA FILE
TM ANCILLARY AND SCD RECORD F

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZAS¥SCDF'
2	2	Scene Sequence Number	99
3	3	Record Sequence Number n='001' - '374'	n
4	14	SCD Along Scan High Frequency Matrix (1,n) (Radians)	E14.7
5	14	SCD Along Scan High Frequency Matrix (2,n) (Radians)	E14.7
.	.		
.	.		
.	.		
38	14	SCD Along Scan High Frequency Matrix (35,n) (Radians)	E14.7
39	14	SCD Cross Scan High Frequency Matrix (1,n) (Radians)	E14.7
40	14	SCD Cross Scan High Frequency Matrix (2,n) (Radians)	E14.7
.	.		
.	.		
.	.		
73	14	SCD Cross Scan High Frequency (34,n) (Radians)	E14.7
74	10	SCD Scan Line Length (n)	I10
75	21	SCD Mirror Scan Start Time Relative to Telemetry Start Time (n)	D21.14

Table 5-11

TM Ancillary and Systematic Correction Data File

TM Ancillary and SCD Record G

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZASWSCDG'
2	2	Scene Sequence Number	99
3	14	Position Vector Scan Rate Forward (kilometers/second)	E14.7
4	14	Position Vector Scan Rate Reverse (kilometers/second)	E14.7
		SCD Nominal Along Scan Focal Plane Band Locations	
5	14	Band 1	E14.7
6	14	Band 2	E14.7
7	14	Band 3	E14.7
8	14	Band 4	E14.7
9	14	Band 5	E14.7
10	14	Band 6	E14.7
11	14	Band 7	E14.7
12	14	SCD Cross Scan Detector Array Center Location (1)	E14.7
.	.		
.	.		
.	.		
18	14	SCD Cross Scan Detector Array Center Location (7)	E14.7

Table 5-11

TM Ancillary and Systematic Correction Data File

TM Ancillary and SCD Record G (cont.)

Item Number	Number of Characters	Item Name	Standard Format
19	14	SCD Cross Scan Focal Plane Detector Spacing (1)	E14.7
.			
.			
.			
25	14	SCD Cross Scan Focal Plane Detector Spacing (7)	E14.7
26	10	SCD DFP Odd Detector Sample Shift Data (1,1)	I10
27	10	SCD DFP Odd Detector Sample Shift Data (2,1)	I10
.			
.			
.			
39	10	SCD DFP Odd Detector Sample Shift Data (7,2)	I10

TABLE 5-11a TM ANCILLARY AND SCD FILE
TM ANCILLARY AND SCD RECORD H

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZAS∅SCDH'
2	12	Scene Sequence Number	99
3	14	SCD Along Scan Focal Plane Detector Location (1,1)* (Forward)	E14.7
4	14	SCD Along Scan Focal Plane Detector Location (2,1) (Forward)	E14.7
.			
.			
.			
114	14	SCD Along Scam Focal Plane Detector Location (7,16) (Forward)	E14.7

*(x,y) indicates band, detector. Band 6 values for detectors 5-16 are zero.

TABLE 5-11b TM ANCILLARY AND SCD FILE
TM ANCILLARY AND SCD RECORD I

Item Name	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZASBSCDI'
2	12	Scene Sequence Number	99
3	14	SCD Along Scan Focal Plane Detector Location (1,1)* (Reverse)	E14.7
4	14	SCD Along Scan Focal Plane Detector Location (2,1)	E14.17
.			
.			
.			
114	14	SCD Along Scan Focal Plane Detector Location (7,16) (Reverse)	E14.7

*(x,y) indicates band, detector. Band 6 values for detectors 5-16 are zero.

Table 5-12 Annotation Data File

Annotation Header Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZANBHEAD'
2	2	Number of Annotation Scene Data Records in this file	99

Table 5-13 Annotation Data Record

Annotation Scene Data Record

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZAN$SCEN'
2	2	Picture Exposure Day (1-31)	99
3	2	Picture Exposure Month(1-12)	99
4	2	Picture Exposure Year(last 2 digits)	99
5	3	Display Center Latitude Degrees	±99
6	2	Display Center Latitude Minutes	99
7	4	Display Center Longitude Degrees	±999
8	2	Display Center Longitude Minutes	99
9	3	WRS Path	999
10	3	WRS Row	999
11	1	Orbital Direction:	X
		X = 'A' for ascending 'D' for descending	
12	3	WRS Scene Center Latitude (degrees)	±99
13	2	WRS Scene Center Latitude (minutes)	99
14	4	WRS Scene Center Longitude (degrees)	±999
15	2	WRS Scene Center Longitude (minutes)	99
16	2	Sun Elevation	99
17	3	Sun Azimuth	999
18	1	Ephemeris Source	X
		X = 'G' for GPS 'P' for OCG Predicted 'D' for OCG Definitive	

Table 5-13 (cont)

Item Number	Number of Characters	Item Name	Standard Format
19	1	Encoded Project Identifier: X = 'E'	X
20	1	Landsat-D Mission Number: X = '4' or '5'	X
21	4	Observation Time: Days since Launch	9999
22	2	Observation Time: Hour	99
23	2	Observation Time: Minute	99
24	1	Observation Time: Tens of seconds	9

TABLE 5-14 QUALITY ASSURANCE FILE
QA HEADER RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZQAbHEAD'
2	1	Number of QA Data - Ephemeris Data Processing Records: X = '1'	X
3	2	Number of QA Data - Attitude Data Processing Records	99
4	2	Number of QA Data - MSCDP Input Data Records	99
5	2	Number of QA Data - MSCDP Output Data Records	99
6	2	Number of QA Data - SCD Scene Data Records	99

TABLE 5-15 QUALITY ASSURANCE FILE
QA DATA - EPHEMERIS DATA PROCESSING RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZQA$IEPH'
2	10	Number of Raw Ephemeris Points	I10
3	10	Number of Rejected Ephemeris Points	I10
4	10	Number of Output Ephemeris Points	I10
5	14	Accuracy of Fit (Meters)	E14.7

TABLE 5-15a QUALITY ASSURANCE FILE
QA DATA - ATTITUDE DATA PROCESSING DATA HEADER RECORD

Item Number	Number of Characters	Item Number	Standard Format
1	8	Record Identification	'ZQABJATH'
2	2	Number of Telemetry Major Frames	99
		Compensated DRIRU data	
3	14	X-Average	E14.7
4	14	Y-Average	E14.7
5	14	Z-Average	E14.7
6	14	X-Standard Deviation	E14.7
7	14	Y-Standard Deviation	E14.7
8	14	Z-Standard Deviation	E14.7
9	14	X-Maximum Deviation	E14.7
10	14	Y-Maximum Deviation	E14.7
11	14	Z-Maximum Deviation	E14.7
12	10	X-Maximum Deviation Index	I10
13	10	Y-Maximum Deviation Index	I10
14	10	Z-Maximum Deviation Index	I10

TABLE 5-16 QUALITY ASSURANCE FILE
QA DATA -ATTITUDE DATA PROCESSING DATA RECORD

Item Number	Number of Characters	Item Name	Standard Format
		INPUT DRIRU DATA	
1	8	Record Identification	'ZQAbJATT'
2	2	Record Sequence Number	99
3	14	X-Average	E14.7
4	14	Y-Average	E14.7
5	14	Z-Average	E14.7
6	14	X-Standard Deviation	E14.7
7	14	Y-Standard Deviation	E14.7
8	14	Z-Standard Deviation	E14.7
9	14	X-Maximum Deviation	E14.7
10	14	Y-Maximum Deviation	E14.7
11	14	Z-Maximum Deviation	E14.7
12	10	X-Maximum Deviation Index	I10
13	10	Y-Maximum Deviation Index	I10
14	10	Z-Maximum Deviation Index	I10
		INPUT ADS DATA	
15	14	X-Average	E14.7
16	14	Y-Average	E14.7
.	.	.	.
.	.	.	.
.	.	.	.
26	10	Z-Maximum Deviation Index	I10
		OUTPUT DATA	
27	14	X-Average	E14.7

TABLE 5-16 (cont.)

Item Number	Number of Characters	Item Name	Standard Format
28	14	Y-Average	E14.7
.	.	.	
.	.	.	
.	.	.	
38	10	Z-Maximum Deviation Index	I10

TABLE 5-17 QUALITY ASSURANCE FILE
QA Data - MSCDP Input Data Record

INPUT DATA

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZQAb/MSCI'
2	2	Record Sequence Number	99
3	14	FST*-Average	E14.7
4	14	RST*-Average	E14.7
5	14	FMI*-Average	E14.7
6	14	RMI*-Average	E14.7
7	14	FEI*- Average	E14.7
8	14	REI*-Average	E14.7
9	14	FST-Standard Deviation	E14.7
.		.	
.		.	
.		.	
14	14	REI-Standard Deviation	E14.7
15	14	FST-Maximum	E14.7
.		.	
.		.	
.		.	
20	14	REI-Maximum	E14.7
21	10	FST-Maximum Index	I10
.		.	
.		.	
.		.	
26	10	REI-Maximum Index	I10

TABLE 5-17 (cont.)

Item Number	Number of Characters	Item Name	Standard Format
27	27	FST-Minimum	E14.7
.	.		
.	.		
.	.		
32	14	REI-Minimum	E14.7
33	10	FST-Minimum Index	I10
.	.		
.	.		
.	.		
38	10	REI-Minimum Index	I10
39	10	Input error number 1	I10
.			
.			
.			
247	10	Input error number 209	I10

Table 5-17 (cont.)

*FST = Forward scan start to reverse scan start interval

RST = Reverse scan start to forward scan start interval

FMI = Forward mid-scan interval

RMI = Reverse mid-scan interval

FEI = Forward end-cand interval

REI = Reverse end-scan interval

TABLE 5-18 QUALITY ASSURANCE FILE
QA DATA - MSCDP OUTPUT DATA RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZQABMSCQ'
2	2	Record Sequence Number	99
3	14	ASD* - Average	E14.7
4	14	CSD* - Average	E14.7
5	14	ASD - Standard Deviation	E14.7
6	14	CSD - Standard Deviation	E14.7
7	14	ASD - Maximum Deviation	E14.7
8	14	CSD - Maximum Deviation	E14.7
9	10	ASD - Maximum Deviation Index	I10
10	10	CSD - Maximum Deviation Index	I10

*ASD = Along - Scan Deviation

CSD = Cross - Scan Deviation

TABLE 5-19 QUALITY ASSURANCE FILE
QA DATA - SCD SCENE DATA RECORD

Item Number	Number of Characters	Item Name	Standard Format
T	8	Record Identification	'ZQAbSCEN'
2	2	Record Sequence Number	99
3	14	AS* - Average	E14.7
4	14	CS* - Average	E14.7
5	14	AS - Standard Deviation	E14.7
6	14	CS - Standard Deviation	E14.7
7	14	AS - Maximum Deviation	E14.7
8	14	CS - Maximum Deviation	E14.7
9	10	AS - Maximum Deviation Scan Number	I10
10	10	CS - Maximum Deviation Scan Number	I10
11	10	AS - Maximum Deviation Sample Number	I10
12	10	CS - Maximum Deviation Sample Number	I10

*AS = Along - Scan High Frequency Matrix

CS = Cross - Scan High Frequency Matrix

TABLE 5-20 TM HOUSEKEEPING DATA FILE
TM HOUSEKEEPING HEADER RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZHKØHEAD'
2	16	Telemetry Interval Start Time	YYDDDHHMMSSTTTFF
3	16	Telemetry Interval Stop Time	YYDDDHHMMSSTTTFF
4	5	Orbit Number:	99999
5	1	Mission Number X = '4' or '5'	X
6	2	Number of TM Housekeeping Data Records in this File	99

TABLE 5-21 TM HOUSEKEEPING DATA FILE
TM HOUSEKEEPING DATA RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identification	'ZHK$HKDR'
2	2	Record Sequence Number	99
3	16	Observation Time	YYDDDHHMMSSTTTFF
4	14	Blackbody Temperature	E14.7
5	14	Silicon FPA Temperature	E14.7
6	14	Calibration Shutter Flag Temperature	E14.7
7	14	Backup Shutter Temperature	E14.7
8	14	Baffle Temperature	E14.7
9	14	Cold Stage FPA Monitor Temperature	E14.7
10	14	Cold Stage FPA Control Temperature	E14.7
11	14	CAL Lamps Filter Temperature	E14.7
12	14	SLC Temperature	E14.7
13	14	CAL Shutter Hub Temperature	E14.7
14	14	Even Ambient Preamp Temperature	E14.7
15	14	Band 6 Post Amp Temperature	E14.7
16	14	Relay Optics Temperature	E14.7
17	14	Cold Preamp Temperature	E14.7
18	14	Odd Ambient Preamp Temperature	E14.7
19	8	Serial Word A	99999999
20	8	" " B	99999999
21	8	" " C	99999999
22	8	" " D	99999999

Table 5-21 (cont).

Item Number	Number of Characters	Item Name	Standard Format
23	8	Serial Word E	99999999
24	8	" " F	99999999
25	8	" " G	99999999
26	8	" " H	99999999
27	8	" " L	99999999
28	14	Primary Mirror Temperature	E14.7
29	14	Primary Mirror Mask Temperature	E14.7
30	14	Secondary Mirror Temperature	E14.7
31	14	Secondary Mirror Mask Temperature	E14.7
32	14	Telescope Housing Temperature	E14.7
33	14	Telescope Baseplate Temperature	E14.7
34	14	Spare	E14.7
35 - 66	14	Quality Indicators	99999999

TABLE 5-22 TRANSFER HEADER RECORD

Item Number	Number of Characters	Item Name	Standard Format
1	8	Record Identifier	FFF'ATRN'
2	10	File Name of this File	FFFXXX.EXT
3	11	Date/Time File Generated	YYDDDHHMMSS
4	4	System Generating this File	'MMFT'

SECTION 6

ABBREVIATIONS, ACRONYMS, SYMBOLS, AND TERMS

6.1 ACRONYMS

ANSI	American National Standards Institute
AOT	APCS Output CCT
APCS	Accelerated Payload Correction Subsystem
ASCII	American Standard Code for Information Interchange
CAL	Calibration
CCT	Computer Compatible Tape
DFP	Data Formatter/Processor
DRIRU	Dry Rotor Inertial Reference Unit
EOF	End-Of-File-Marker
FPA	Focal Plane Assembly
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
GS	Landsat-D Ground Segment
HDT-RT	High Density Tape Containing Raw TM Data
IRIG	Inter-Range Instrumentation Group Time Code
MMF-T	TM Mission Management Facility
MSCD	Mirror Scan Correction Data
MSCDP	Mirror Scan Correction Data Processing
NASA	National Aeronautics and Space Administration
PCD	Payload Correction Data
PIR	Program Information Release
PS	Polar Stereographic
QA	Quality Assurance
SCD	Systematic Correction Data

SLC	Scan Line Corrector
SOM	Space Oblique Mercator
TM	Thematic Mapper
UTM	Universal Transverse Mercator
WRS	World Reference System

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6.2 STANDARD FORMATS

FORMAT	NAME	DESCRIPTION
9	Numeric	Any numeric value (0-9), single character
9...9	Numeric String	A string of numeric characters; The length of the string is equal to the number of 9's
X	Alphanumeric	Any alphanumeric value (0-9, A-2 blank plus, minus, period), single character
X...X	Alphanumeric String	A string of alphanumeric characters; The length of the string is equal to the number of X's
'X...X'	Literal	An alphanumeric or alphanumeric string. The value of the literal is as specified between the quotation marks
SSSYYYDDDXXXX	Process Request Identification	SSS = 'ADD' YY = Last 2 digits of year DDD = Day of year ('001' - '366') XXXX = Sequence number of process request within day ('0001' - '9999')
FFFXXX.EXT	File Identification	FFF = File Type indicator: 'ZTD' = Tape Directory File 'ZPR' = APCS Process Request File 'ZEP' = Telemetry Interval Emphemeris File 'ZAS' = TM Ancillary and SCD File 'ZAN' = Annotation Data File 'ZQA' = QA File 'ZHK' = TM Housekeeping Data File XXX = Sequence number (001-999) EXT = Extension: 'AOT' = APCS Output CCT

YYDDD	Date	YY = Last two digits of year DDD = Day of year ('001' - '366')
YYDDDHHMMSS	Time in Seconds	Date and Time of Day: YY = Last two digits of year DDD = Day of year ('001' - '366') HH = Hour MM = Minute SS = Second
YYDDDHHMMSSTTT	Time in Milliseconds	Same definition as Time in Seconds, adding: TTT = Milliseconds
YYDDDHHMMSSTTTFF	Time in Sixteenths	Same definition as Time in Milliseconds, adding: FF = sixteenths of milliseconds ('00' - '15')
DDDHHMMDDT	IRIG TIME	DDD = Day of year HH = Hour MM = Minute SS = Second T = Tenths of Second
MNSTTYYDDDXX	Tape Identification	Unique tape identifier, where M = 'L', for Landsat Mission Identifier N = Landsat Mission Number: '4' = Landsat-D '5' = Landsat-D Prime '0' = Mixed Landsat-D and Landsat-D Prime S = Sensor 'T' = TM TT = Tape Type "HR' = HDT-R YY = Last two digits of year DDD = Day of year XX = Sequence number of tape within day
NSPPPRRRDDD	Geographic Scene Identification	Unique identification of a Landsat Scene, where: N = Landsat Mission Number: '4' = Landsat-D; '5' = Landsat-D Prime S = Sensor: 'T' = TM PPP = Path RRR = Row DDDD = Days since Launch of Acquisition

NDDDHHMMT	NASA Scene Identification	Non-unique identification of a Landsat-D scene, where: N = Landsat Mission Number '4' = Landsat-D '5' = Landsat-D Prime DDDD = Days since Launch of Acquisition HH = Hour MM = Minute T = Tens of seconds
Ø	Floating Point Normalizing Zero	A single character numeric exteral; value is 'Ø'
.	Physical Decimal Point	A single character alphanumeric literal; value is '.'
V	Implied Decimal Point	Position of implied decimal point indicates where a physical decimal point would be if it were to be included in the numeric string. For example, a numeric string 99V999 is 5 characters long and has an implied decimal point after the second character from the left.
±	Signed Literal	A single character alphanumeric literal; values are plus ('+') or minus ('-')
E	Exponent Literal	A single character alphanumeric literal; value is 'E'

I4	Signed	±999
I10	Signed	± 999999999
I20	Signed	± 99999999999999999
E14.7	Floating point, Single	± Ø. 9999999E±99
D21.14	Floating Point, Double	± Ø. 99999999999999E±99

APPENDIX I

Reference Program Information Releases